CLAIMS

What is claimed is:

1. A microelectromechanical device, comprising

a. a rotating element including a first electrode;

b. a vertical stop disposed proximate the rotating element;

c. a second electrode;

d. means, coupled to the first and second electrodes for measuring a capacitance between them; and

e. means coupled to the capacitance sensing means for determining from the capacitance a digital control state of the device.

2. The device of claim 1 further comprising means for determining a deviation from a desired control state.

3. The device of claim 1 wherein the element has two control states.

4. The device of claim 1, further comprising means for rotating the rotatable element.

5. The device of claim 1 wherein the element is a MEMS mirror.

6. A microelectromechanical system (MEMS) apparatus, comprising

a. an element configured to rotate between a first control state and a second control state;

b. a vertical stop disposed proximate the element;

c. one or more electrodes disposed proximate the element, wherein a capacitance between the element and the one or more electrodes has a first value when the element is in the first control state and the capacitance has a second value when the element is in the second control state;

d. means, for measuring a value of the capacitance between the element and the at least one of the one or more electrodes; and

e. means coupled to the capacitance sensing means for determining a control state of the element from the value of the capacitance.

7. The device of claim 6 wherein the first and second angular positions are substantially 90° apart.

8. The device of claim 6 further comprising means for actuating the element.

9. The device of claim 6 further comprising means for electrostatically clamping the element in at least one of the first and second positions.

10. The device of claim 9, wherein the clamping means comprises a clamping voltage source electrically coupled to one or more of the one or more electrodes.

11. The device of claim 6, further comprising a substrate, wherein the element connected to the substrate by a hinge.

12. The device of claim 11, wherein the one or more electrodes includes an electrode disposed on the substrate proximate the element.

13. The device of claim 11, wherein the substrate includes a vertical stop disposed proximate the element.

14. The device of claim 13, wherein the one or more electrodes includes an electrode attached to the vertical stop.

15. The device of claim 6, wherein the element is a MEMS mirror.

16. A method for sensing the control state of a microelectromechanical device, comprising:

measuring a value of a capacitance between a rotatable element and one or more of a first and second electrode disposed proximate the rotatable element to determine whether the rotatable element is in a first control state, a second control state, or neither the first nor second control state,

wherein the rotatable element is in a vertical position proximate a vertical stop when the rotatable element is in the first or second control state.

17. The method of claim 16, further comprising applying an electrostatic clamping voltage to one or more of the first and second electrodes.

18. The method of claim 17, wherein the clamping voltage is a DC voltage and c) includes superimposing an AC signal on the clamping voltage.

19. The method of claim 17, wherein the clamping voltage and a sensing signal are alternately applied in time.

20. The method of claim 16 further comprising determining the presence of a fault in the

microelectromechanical device from the value of the capacitance.

21. The method of claim 16 further comprising using the value of the capacitance to time the actuation of the element.

22. An optical communications system, comprising:

a) one or more input optical fibers;

b) one or more output optical fibers;

c) a microelectromechanical system (MEMS) optical switch including:

i) one or more MEMS mirrors configured to rotate between a first angular position and a second angular position;

ii) b. a vertical stop disposed proximate one or more of the MEMS mirrors;

iii) one or more electrodes disposed proximate each of the one or more mirrors, wherein a capacitance between the mirrors and the electrodes has a first value when the mirrors are in a first control state and the capacitance has a second value when the element is in a second control state;

iv) means, for measuring a value the capacitance between at least one of the one or more mirrors

and the at least one of the one or more electrodes; and

v) means coupled to the capacitance sensing means for determining a control state of the element from the value of the capacitance.